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ABSTRACT

The phonological switching processes of 16 bilingual (Spanish-English) adults were observed to provide phonological evidence for the coordinate/compound theory of bilingualism. Each subject was categorized as a coordinate or compound based on responses to a questionnaire. Subjects were recorded reading a mixed list of Spanish and English words. The results were distinctive for both the coordinate and compound groups. Speculations were made concerning possible phonological models for both bilingual groups. An explanation of the test results is based on the operation of the proposed coordinate and compound phonology systems. Implications for further related research are mentioned following a discussion of the results. This study has demonstrated that, in this instance, Spanish and English bilinguals store their Spanish and English phonologies as either one combined system or as two independent systems.
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PHONOLOGICAL EVIDENCE FOR COORDINATE AND COMPOUND
BILINGUALISM

by

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Chapter I: Background and Statement of Problem

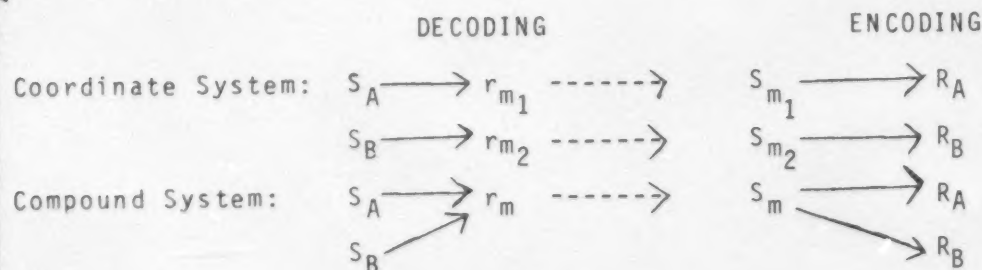
Bilingualism is a language process that has been discussed, researched and misunderstood over the past few decades. Representatives from the fields of education, psychology and linguistics all contributed their findings and their definitions of bilingualism. Educators such as Malherbe (1946) define bilingualism in terms of the mode of instruction used in schools, while the acquisition of L_2^* is in process. Psychologists view bilingualism as a neurological process where two adjacent neural structures function in a reciprocal manner. Linguists on the other hand, address themselves to the overt manifestations of bilingualism such as interference.

The research performed in each respective field, confirmed the notion that all bilinguals were not equal with regards to their competence and performance in both languages. With the recognition of psycholinguistics as a field of study, research emerged dealing with both the overt and covert aspects of bilingualism. Tests were constructed in an attempt to measure the language proficiency, capacity and performance of a bilingual. Such investigations both past and present, contribute to the major classificatory system of bilinguals, namely coordinate/compound.

Superficially, it appears that research in bilingualism has made significant progress, since such an economic dichotomy has been established by which all existing and future bilinguals can be classified. Unfortunately, in pursuing the topic of bilingualism, one must conclude that the coordinate/compound distinction is not as clear cut nor as widely accepted as we are led to believe. What exists in conjunction with the above mentioned classification are other dichotomies which are sometimes synonymous with the coordinate/compound system and occasionally are not. In addition, we also find varying definitions of coordinate and compound bilingualism which contribute to the existing confusion. Consequently, the present state is a misinterpretation of bilingualism. The ill effects of our inability to arrive at a common definition of bilingualism is evident in the failure of bilingual education programs as cited by Kanon 1972.

Definitions of Bilingualism

The most common bilingual dichotomy, coordinate/compound, is given both broad and narrow definitions by various researchers. Ervin and Osgood (1954) somewhat narrowly define the coordinate bilingual as an individual possessing two separate languages where a symbol in L_1 has a referent different from the corresponding symbol in L_2 . While the compound bilingual having acquired two languages under the same conditions has a symbol in L_1 with the same referent as the corresponding symbol in L_2 . Ervin (1964) clarifies this definition with her diagram of the decoding and encoding process of both coordinate and compound bilinguals.



*throughout this paper L_1 will refer to the first language and L_2 will refer to the second language

Viewing the same dichotomy in a very narrow sense is Lambert (1958) who focuses on the conditions of L₁ and L₂ acquisition as the determining factors in the coordinate/compound classification. A coordinate bilingual is an individual who learned L₁ at home and L₂ outside of the home environment; or who learned L₁ from one parent and L₂ from the other; or who acquired L₁ and L₂ in their cultural settings respectively. On the other hand, the compound counterpart learned L₁ and L₂ from both in and out of the home environments; or learned L₁ and L₂ from parents who used both languages; or who used L₁ as a medium of instruction for L₂. Although this definition seems to be quite specific, it does not account for the important child-adult distinction in second language acquisition as discussed by Lenneberg (1967). Based on extensive research, he suggests that before the age of puberty (13) the brain function is susceptible to the neurophysiological processes of language. After the age of puberty however, the brain is less flexible and less able to take on certain tasks, such as language acquisition.

In 1969, Lambert revises his definition with a simplification of the 1958 version, along with the inclusion of this child-adult distinction in L₂ acquisition. A coordinate bilingual then, is an individual who learned L₂ sometime after the age of 10 and usually in a setting other than the family. The compound bilingual is the individual raised in a thoroughly bilingual home environment from infancy on.

The basis for such differentiation within one classification of bilinguals is the focus of the definition. In the above examples, the focus is either on the age of the L₂ acquisition; the conditions of the L₂ acquisition; the semantic processes of bilinguals; or a combination of any of these three factors. Similarly, other dichotomies were formed by focusing on different aspects of bilingualism. For example, in the *Modern Language Journal* (1963) Lambert makes a classification of bilinguals based on the number and degree of skills acquired in each language. He regards a balanced bilingual as a person demonstrating essentially similar skills in both languages, and a linguistic dominant bilingual as one with greater facility measurable in one of the two languages.

Another dichotomy basing its definition on language skills is provided by Weinreich (1953). His classification includes the coordinate bilingual who he defines as a speaker of two languages; L₂ being acquired during childhood as a second native language, or a "perfect" mastery of the L₂ later in life. On the other side of the spectrum, he has the subordinate bilingual who is a speaker of two languages with non-native proficiency in the L₂.

Discussion of the classificatory systems so far, has demonstrated the confusion that exists regarding the terminology used to group bilinguals. As the dichotomy proposed by Weinreich clearly points out, not only have alternative categories been formulated for the coordinate/compound dichotomy but contradicting definitions are used for categories bearing the same name. The definition Weinreich uses for a coordinate bilingual for example, is a combination of the definitions used for a coordinate bilingual and compound bilingual as proposed by Lambert et. al. In addition, it is interesting to glance at a partial listing of other dichotomies proposed by various researchers into which bilinguals can be grouped, as cited at the International Seminar on Bilingualism (1967): organic/inorganic; individual/national; stable/unstable; balanced/unbalanced; pure/mixed; simultaneous/sequential; comprehensive/limited; organized/incidental; general/specific; and regressive/progressive.

Leaving the discussion of dichotomies we turn to another means of describing bilingualism, by using a definition of bilinguals or a category of bilingualism. As an example of the inconsistency also found in this system, we look at one definition by E.G. Malherbe (1946):

"Bilingualism is the coexistence in the same individual of 2 distinct sets of linguistic symbols of communication."

and compare it to the definition by Gardner, R.D. and Havelka J. (1959):

"Bilinguals by definition have learned 2 symbols for each referent and there should be some functional connection between the bilinguals' 2 sets of symbols."

Essentially, Malherbe is describing the coordinate bilingual system, while Gardner refers to the compound, yet each is completely defining bilingualism.

One final method of defining bilingualism is by a scale using the categories of a dichotomy as the two extreme points. Supporting the notion of measuring bilingualism this way is a statement by Weinreich (1961):

"Bilingualism need not be entirely compound or coordinate since some symbols of a language may be compounded while others are not."

Earlier Studies on Bilingualism

Most of the studies on bilingualism were designed to either support the coordinate/compound dichotomy, or to test for language dominance. Gardner (1959) reports on two such tests designed to measure language dominance.

The first, a word completion test, the subjects were presented with a two phoneme sequence which was a common beginning phoneme sequence in both of the bilinguals' languages. They were then instructed to name as many words as they could within one minute that contained the indicated initial phoneme sequence, and they were encouraged to make their word completions in both languages. The number of words uttered in L_1 was compared to those uttered in L_2 , and the language with the majority of responses was considered the bilinguals' dominant language.

A similar design is called a Verbal Response Test which also measures language dominance. In this variety, a bilingual subject is presented with a mixed list of Spanish and English words which have identical spellings in both languages and is instructed to read the list. An individual dominant in English for example, would read a majority of the words with English pronunciation, while a balanced bilingual would elicit as many responses with L_1 phonology as with that of L_2 .

In both of the above examples, measurement has been based on a verbal response. Other similar testing designs are based on aural instead of oral performance. A subject will be instructed to give a physical response to aural commands presented in either L_1 or L_2 . With regards to this measure, Lambert (1955) states:

"If one were perfectly bilingual, there should be no difference between the speeds of response in the two languages."

Consequently, a measurable difference between the speed of response in L_1 from L_2 would indicate language dominance.

Turning to studies providing supportive evidence for the coordinate/compound classification, we can cite three basic testing designs as discussed by Puhvel (1969). One type uses semantic satiation to distinguish coordinates from compounds. It is believed that the coordinate will not demonstrate cross language semantic satiation since by definition, he is the bilingual with two separate language systems. However, the compound will experience this cross language satiation since he is the bilingual with two language systems fused into one.

A second measure involved word recall which attempted to prove that the semantic difference of translated equivalents in L_1 and L_2 was greater for the coordinate than for the compound. Results consistently indicate that in recalling a list of words in L_1 , compound bilinguals profited by rehearsing in advance with a list of translated equivalents in L_2 . This indicates that there is a dependency across languages for the compound which was not evident for the coordinate, who did not benefit by such an advance rehearsal.

The third type of study promotes this coordinate/compound dichotomy based on language research performed with aphasia patients. Concerning this study Fillenbaum (1959) remarks:

"It follows... that any specific brain damage resulting in aphasia would be likely to affect all languages of the compound bilingual, but should lead to more selective disturbance for the coordinate bilingual."

Accordingly, test results are consistent with the coordinate/compound hypothesis of bilingualism.

Current Studies on Bilingualism

The major difference between earlier studies and current studies in bilingualism is due to the surging interest in language switching. Prior to this, as discussed above, researchers were investigating bilingual language skills (balance and dominant bilinguals) or evidence for the coordinate/compound dichotomy. The new focus however, is interested in the bilinguals' ability to be able to set aside a whole linguistic system while functioning with a second one, then at a moment's notice making the previously inactive system active while the previously active one is set aside i.e., language switching.

The question that must be currently answered is posed by Lambert (1969):

"Does the activation of processes in L_1 make L_2 system inoperative?"

Uriel Weinreich suggests that any useful theory of bilingualism must account for the effective separation of two languages (linguistic independence) as well as for the interference that takes place between the two languages (linguistic interference). Since Macnamara (1967) regards the distinction between coordinate and compound as essentially a distinction between linguistic independence and linguistic interference at the semantic level, this current research can be considered merely an elaboration of earlier studies instead of a new trend in research on bilingualism.

One current study was reported by Lambert (1969) where it is suggested

that there is some type of switching mechanism in the brain which shuts off one linguistic system while the other is in function. In order to test this hypothesis, a design was needed that would present the bilingual with a conflict where both languages would be simultaneously called upon. The formulated test is now known as the bilingual version of the Stroop Test. A sample item from this test contains a color naming word in L₁ which is presented in a color other than its name:

ROUGE	(printed in yellow)
VERT	(printed in red)
BLEU	(printed in brown)

The subjects were instructed to name the color the word was written in using L₂. A sample response is:

yellow
*green
brown

According to the author, the error made (green) reveals that the encoding system is dominant for English (the switch was on for English) but the French decoding process became fused with the English encoding process.

The Study of Bilingualism Discussed in This Paper

In 1970 Jakobovits remarked:

"The ideal coordinate bilingual represents a state of complete functional independence of 2 language/cultural systems in all their aspects: semantic, lexical, syntactic, phonological, morphemic, cultural, attitudinal, etc."

The above statement implies that the coordinate bilingual should demonstrate a complete separation of language systems and that this separation should be evident in all the components of a language. The bilingual on the opposite extreme, the compound, therefore must demonstrate absolutely no separation of language systems.

As evidenced by the discussion of earlier studies in bilingualism in this paper, and by a statement by Macnamara (1967), it is obvious that the distinction between coordinate and compound bilinguals has been based solely on the semantic component of language. Yet, according to Jakobovits, there should be similar evidence from other language aspects to support this coordinate/compound theory of bilingualism.

Again returning to the discussion of earlier studies, it is interesting to note the apparent lack of interest in pursuing evidence for the balanced vs. unbalanced bilingual in current studies. Although separate studies were conducted to provide evidence for both the coordinate/compound and the above mentioned dichotomies, the parallelism should be obvious. If an individual possesses two separate language systems, as the coordinate is believed to have, then he should be able to augment one language system without having an affect on the other, i.e. he can become an unbalanced bilingual. On the other hand, the individual with two language systems fused into one, is not able to augment one system without affecting the other, therefore will always be balanced in both languages. Jakobovits (1970) offers some support to this parallelism:

"In its extreme form, coordinate bilingualism represents linguistic schizophrenia; one individual with 2 separate and theoretically unrelated cultural-linguistic systems co-occur

within the same body. In compound bilingualism the 2 linguistic systems are so fused and interdependent that the second language represents a mere alternative channel for the overt manifestation of the same underlying system represented by the first language. In its extreme form, compound bilingualism represents a translation machine. For every coded bit in L_2 there must be a corresponding bit in L_1 with the relationship between the two exactly specified."

Accordingly, a study of coordinate/compound bilingualism is simultaneously providing evidence for balanced vs. unbalanced (dominant) bilinguals.

In this study on bilingualism, evidence to support the coordinate/compound bilingual theory will be sought from the phonological component of language. That is to say, evidence from phonological performance will support the notion that certain bilingual individuals store two languages separately, while others store two languages as one system. Although enough evidence is available to suggest that a typical sample of bilinguals distribute themselves along a continuum of coordinateness and compoundness, nevertheless, Puhvel (1969) suggests it is interesting to study and contrast the two extremes.

The following study will be measuring the facility to switch from one language to another in conjunction with the amount of interference experienced after each switch. The essence of this study is explained in the following hypothesis. Coordinate bilinguals who have separately stored their two language systems will experience ease in switching from the phonology of one language to the phonology of the other with minimal or no interference. Compound bilinguals who have jointly stored their two language systems will experience difficulty in language switching with significant phonological interference.

Chapter II: Method

Subjects

The subjects were 16 bilingual (Spanish-English) adults who are presently employed as bilingual/bicultural teachers or coordinators in various Chicago Public Schools. Each subject has an educational background equivalent to at least a Bachelor of Arts degree in the United States.

The designation of a bilingual speaker was initially determined by the nature of work the subject is engaged in. In addition, all 16 subjects met at least the following criteria for L_2 proficiency as prescribed by the Peace Corps Language Proficiency Test for their category 3. It is this category into which most university professors of foreign language are categorized, according to Mr. Protase Woodford, a Peace Corps foreign language interviewer.

Category 3--able to speak the language with sufficient structural accuracy and vocabulary to participate effectively in most formal and informal conversations on practical, social and professional topics. Can discuss particular interests and special fields of competence with reasonable ease; comprehension is quite complete for normal rate of speech; vocabulary is broad enough that he rarely has to grope for a word; accent may be obviously foreign; control of grammar good; errors never interfere with understanding and rarely disturb the native speaker.

The manner in which it was determined that each subject met at least the above

criteria, was by prior knowledge of the subjects' L₂ proficiency, or by an informal brief conversation with the subject before² administering the test.

The term bilingual, as used in this paper, refers to an individual with good listening and speaking skills in addition to at least average reading ability in L₁ and L₂. The basis for this measurement is made solely at the performance level.² The degree to which writing proficiency in L₁ and L₂ occurred, was not taken into consideration, although it may be noted that all 16 subjects did possess at least average skills in both reading and writing in L₁ and L₂.

A final important note concerns the proficiency a bilingual has with regard to L₂ phonology. In dealing with a study based on phonological switching between two languages, it would seem essential that the bilingual possess native-like proficiency in both phonologies. Yet, in the criteria for selection, an eligible subject may have an obvious "foreign accent".

According to Stockwell and Bowen (1965) the teaching of pronunciation in L₂ should follow this order of importance:

1. The segments that cause misunderstanding
2. The segments that produce obvious accent
3. All others

For the purpose of this paper, those segments under #1 are the phonemes of L₂. That is, once the bilingual has mastered all the phonemes and phonemic contrasts in L₂, misunderstanding will be negligible. In step #2, the segments are the phonetic peculiarities in L₂ which will cause foreign accent, but will not hinder understanding. It is the bilingual who is at step #2 or beyond in the phonology of L₂ that has been accepted as a subject for this study.

Procedure

Each subject was tested individually in a location relatively free from interruption. The test was divided into three sections, the first section involved monolingual instruction and stimulus, while sections II and III involved monolingual instruction but bilingual stimulus. The subjects were able to choose which language (Spanish or English) they preferred the monolingual portions of the test to be administered in.

Section I of the above test was in the form of a questionnaire which supplies information about the bilinguals' L₁ and L₂ acquisition contexts; age of L₂ acquisition; length of time L₂ has been spoken, and which language, if any,² is dominant. (See Appendices A and B). Whichever language the subject selected the questionnaire in was the language used for all oral instruction.

Section II of the test was an attempt to provide additional evidence for each subject regarding his participation in the coordinate bilingual group or the compound. This part involved the semantic aspects of the bilinguals' two languages, which is the common approach used to classify bilinguals as to coordinate or compound. Each subject was instructed to listen to 2 words, which consisted of one word in L₁ and its equivalent in L₂. He was asked to form a mental picture after he heard each word, and then to indicate whether the mental images for the 2 words were alike or different. (See Appendix C). The lexical items selected for section II were 5 concrete nouns which could theoretically have different connotation in Spanish and in English. Since Ervin (1965) states that semantic differences between two languages are connotative rather than denotative, it was decided that these particular lexical items would be adequate. Later evidence in support of the existing connotative differences between the words in L₁ and L₂ was provided through

candid remarks by at least one subject for each lexical item.

Section III of the test consisted of reading a mixed word list (Spanish and English) which created the opportunity for language switching. Each subject was first administered a practice test consisting of 40 words, 20 in English and 20 in Spanish. (See Appendix D). This word list was composed of nouns and verbs in both languages. No word listed in one language was given in the other language as a translation, so that this practice list consisted of 40 different lexical items.

Each word was printed on a 5" x 5" card, and all 40 cards were placed on a set of rings. In this manner while reading the list, the subject was able to focus on only one word at a time. The 20 English and 20 Spanish words were mixed so that at the beginning of the list, groups of 2-3 words from the same language would occur. Toward the end of the list, a complete one to one alternation resulted between English and Spanish lexical items.

Instructions were given for each subject to read all the words in the practice list. It was explained, that the list was composed of both Spanish and English words, and furthermore that all Spanish words were printed in red and all English words were printed in black. No time limit was specified and all responses were recorded.

Upon completion of the practice list, the subjects were instructed to read a subsequent list called the test list. The words in this group were also composed of 20 English and 20 Spanish words. (See Appendix D) This group also contained nouns and verbs in both languages, and as in the practice list, consisted of 40 completely different lexical items. Identical to the words in the practice list, each item in the test list was printed on a separate card, Spanish in red and English in black. Similarly, the language alternations followed the pattern described for the practice list.

The outstanding difference between the practice list and the test list lies solely in the selection of particular English and Spanish lexical items for the test list. The words selected for this group were those having identical spellings in both languages, but maintaining an unique phonological form in each language. Dividing these test list words based on semantics, results in two basic types. The first word type is the lexical item with identical spelling and identical denotative meaning in Spanish and in English. The first 14 items in the test list are examples of this first word type. (Florida, popular, interior, etc.) The second word type is the lexical item with identical spelling but with a different denotative meaning found in English and in Spanish. A list of words of this type follows:

<u>LEXICAL ITEM</u>	<u>SPANISH DENOTATIVE MEANING</u>
sin	without
dime	verb form of dar - to give
sale	verb form of salir - to leave
hay	there is/there are
come	verb form of comer - to eat
fin	end
pan	bread
brillo	sparkle
son	verb form of ser - to be
pie	foot
real	royal
seas	verb form of ser - to be
vine	verb form of venir - to come
mayor	older
lean	verb form of leer - to read
dan	verb form of dar - to give
case	verb form of casar - to marry

It may be noted, as with the practice list, each subject was instructed to read the list of words without a specific time limit, and with all responses being recorded.

Section III of this test is similar to a test described in the section on Earlier Studies on Bilingualism. It is not my objective however, to duplicate that testing procedure nor to duplicate their results. The test in reference did contain a list of lexical items similar to those used in the test list for this present study. However, the words were not color coded for any language. It was the objective of that test to determine language dominance and therefore the subjects read the items in the language of their choice. In this present study, the objective is to observe language switching and therefore each word has been color coded to cue the subject as to which phonological system he should consult.

Coordinate/Compound Criteria

It is important to discuss the procedure that was used to classify the subjects as coordinate or compound bilinguals, since the results from this study will provide additional evidence for the existence of that particular dichotomy. The questions in sections I and II of the test, were designed specifically to secure information that would facilitate the classification of subjects into these 2 groups.

As discussed earlier, the basis for defining coordinate/compound has been dependent on either the age of L_2 acquisition; the context of L_2 acquisition; or the semantic referents in L_1 and L_2 . In addition to this criteria, I would like to add language dominance. As stated before, there appears to be a logical parallelism between coordinate and language dominant bilinguals; and compound and language balanced bilinguals.

The categorization of subjects into the coordinate/compound dichotomy, was initially made on the basis of the language dominance factor. The subjects indicating they felt dominant in one language were placed into the coordinate group and those stating they felt the same in both languages were placed in the compound group. It is interesting to note that the 10 subjects indicating language dominance, all selected the test to be administered in their dominant language, while the 6 compound subjects appeared to randomly select the language of instruction; 3 selected Spanish and 3 selected English.

The second factor taken into consideration was the context of L_2 acquisition. Surveying the responses to section I of the test, reveal the following L_1/L_2 acquisition contexts for coordinate bilinguals: home/school; country₁/country₂; parent₁/parent₂; and parent/siblings. The sample of compound bilinguals indicated their L_1/L_2 acquisition contexts were: country₁/country₂; and parents/parents.

In comparing the language acquisition contexts for both groups, it superficially appears that no significant difference emerges between the manner in which coordinates and compounds acquire their L_2 . Investigating the contexts one step further however, reveals a major distinction. The coordinate bilingual who acquired L_1 in its cultural setting (country₁) and L_2 from its cultural setting (country₂) either spoke L_1 in country₁ for more years than L_2 in country₂, or L_2 in country₂ for more years than L_1 in country₁. Consequently, the language that has been used for a longer period of time in its cultural setting has become the coordinates' dominant language. For example, one subject acquired Spanish as her L_1 in Mexico and used L_1 solely for 9 years. At this point she began learning English as her L_2 in

the United States while maintaining the L_1 at home. At the time of this study, the subject had been using L_2 for 20 years and considered the L_2 as her dominant language, although L_1 is still actively in use at work² and at home.

Turning to the compound bilingual who acquired L_1 and L_2 in a similar manner, (country₁/country₂) the time factor once again becomes important. Those subjects who are balanced in both languages have spoken L_2 for nearly the same number of years as L_1 at the time of testing. Although these subjects also actively use L_1 at home, the fact that L_2 is used in its cultural setting must have a significant impact on the bilinguals' acquisition and maintenance of that language.

A third factor to consider is the age of L_2 acquisition. At a glance, it appears that age is irrelevant to the classification of coordinate/compound bilinguals, since representatives from both groups acquired L_2 at any age between infancy and adulthood. Taking this criterion a bit further however, again reveals the real distinction. If the coordinate acquired L_2 at infancy, he experienced some distinct learning environment. Either L_2 was used with only one parent, or more likely, L_2 was only used with peers and siblings. The compound who learned L_2 at infancy however, did not encounter a distinct learning situation, most frequently using L_1 and L_2 with parents, siblings, and peers.

The final criterion to look at comes from section II of the test. As stated above, this section relies on the semantic aspects of language. It was anticipated that the information from section II would be in accordance with that provided by section I with regards to grouping the subjects into coordinate or compound categories. However, the information from sections I and II are very much in discord. Of the bilinguals classified as coordinate based on the information in section I, 5 would be classified as compound based on the information from section II and 5 might be considered coordinate. On the other hand, 2 of the bilinguals placed in the compound category according to information from section I, would be considered coordinate based on semantic information, while the remaining three would be classified as compound according to the information from both section I and II.

Since no single factor could be discovered to which this inconsistency can be attributed, there remains only one explanation. The design in section II was not valid to determine coordinate/compound bilingualism based on semantic information. It was only an attempt at devising a simple means by which the classification of bilinguals based on section I might be confirmed. The design in section II unfortunately, was not based on any prior test that determined the semantic process of bilinguals, and this seems a likely reason for its insufficiency.

Chapter III: Results

A comparison of the responses from the coordinates and compound bilinguals in the areas of error analysis; interference; switching time; and total reading time is contained in the following TABLE I and TABLE II:

TABLE I Coordinate Bilinguals

# ERRORS practice/test list list	INTERFERENCE ERRORS	OTHER ERRORS	TYPE I / TYPE II	PRACTICE TIME TEST TIME	INTERVAL TIME CHANGES
0/0	----	----	----	1:25min 1:35min(+10)	5
0/0	----	----	----	1:27 1:37 (+10)	9
0/1	1	0	1/0	1:37 1:25 (-12)	6
0/1	1	0	1/0	1:53 1:20 (-33)	12
0/2	2	0	1/1	1:37 1:50 (+13)	12
0/2	2	0	1/1	1:12 1:29 (+17)	9
0/2	2	0	1/1	1:43 1:50 (+7)	11
0/2	1	1	2/0	:50 1:05 (+55)	8
0/5	4	1	5/0	1:20 2:21 (+1:01)	23
0/7	5	2	7/0	1:11 1:53 (+42)	19
TOTAL /22	18(82%)	4	19/3	-33 - +1:01	5 - 23

TABLE II Compound Bilinguals

# ERRORS practice/test list list	INTERFERENCE ERRORS	OTHER ERRORS	TYPE I / TYPE II	PRACTICE TIME TEST TIME	INTERVAL TIME CHANGES
0/3	1	2	1/2	1:10min 1:05min (-5)	3
0/3	2	1	3/0	1:05 1:15 (+10)	8
0/5	3	2	5/0	1:13 1:21 (+8)	7
0/7	4	3	2/5	1:02 1:03 (+1)	5
0/10	5	5	6/4	1:25 1:35 (+10)	6
0/13	10	3	7/6	1:27 1:30 (+3)	4
TOTAL /41	25(60%)	16	24/17	-5 - +10	3 - 8

The first column of each table enumerates the errors made during the practice list and the test list. An error was counted every time the subject used the incorrect phonology. For example, if a word printed in red, was uttered with English phonology, the response was counted as one error. In comparison, the coordinates scored from 0-7 errors, while the compounds scored 3-13 errors. These results show an overlap between both groups due to the responses of 2 subjects in TABLE I who scored 0/5 and 0/7 respectively. It is interesting to note that both these subjects did not learn the color coding rule that was drilled on the practice list. Both stopped shortly after beginning the test list to ask that the color coding rule be repeated. After a second brief explanation, each subject scored 2 more errors and then completed the test list without error. Assuming that the reason for these coordinates scoring the number of errors as they did, is related to their lack of understanding the color coding system, the results can be analyzed in two ways. If their errors are not counted in the range of errors for the coordinate group, then it can be stated that the coordinates scored 0-2 errors, while the compounds scored 3-13 errors, with no overlap in the analysis. Viewing the results in another way, the errors counted after the repetition of the color coding rule are 2 in number. Counting 2 errors for each of these 2 subjects, permits the number of errors for each group to provide significant evidence for a distinction between coordinates and compounds.

Mention must also be made of the perfect score each subject achieved on the practice list, and the distribution of errors by both groups of bilinguals. The errors of the coordinates, if not all occurring at the beginning of the test list, all occurred in proximity. The errors of the compounds were however, evenly distributed throughout the test list.

The information contained in columns two and three, is a result of dividing the number of errors into those caused by interference and those attributed to other reasons. If the error is a result of maintaining the phonology of the language from the preceding lexical item when a switch in phonologies should have occurred, the error is blamed on interference. For example, when reading the following sequence; interior, vision, popular*, pan, a subject reads -popular- with English phonology, that is considered an error of interference since the switch was already on for English from the preceding lexical item. If however, the subject reads -vision- with Spanish phonology, this is counted as an error for other reasons since the preceding lexical item in English, offers no opportunity for interference. In this category, the majority of the coordinates' errors were due to obvious interference, while the compounds almost equally divided their errors among those based on interference and those based on other reasons. This observation again provides evidence for the classification of bilinguals into 2 different groups.

Recorded in the fourth column are the words on which errors were made, either due to interference or other reasons. These words were divided into two types, as explained earlier in Chapter II. A significant result is obtained in comparing the two groups of bilinguals once again. The coordinates centered their errors on type I words, whereas the compounds almost equally distributed their errors between type I and II words.

Timing is the significant factor considered in the last two columns in both tables. Comparing the overall practice times or test times for each group would not be valid since each subject was permitted to read both the practice and test lists at their own pace. However, a comparison of the time needed to read the practice list versus that for the test list can be made for each individual subject to reveal an interesting observation. The coordinate bilinguals as a group exhibit a more significant difference, either plus or minus, between

practice list time and test list time then do the compounds. A summary of these results reveals the following distribution: coordinates have a differential of -33 seconds to +1:01 minutes, while for the compounds the differential is only -5 - +10 seconds.

In order to explain the significance of switching time as recorded in the last column, a general observation must first be expressed. It was easily observed, that both the coordinates and the compounds read through the practice list at a continuous rate of speed. The test list however, caused a slight irregular reading pattern for the compounds and a highly irregular pattern for the coordinates.

Timing the responses for each subject, provided evidence for the above observation. During the practice list, if a subject allowed for a 2 second interval between the first and second word on the list, this same interval would be maintained throughout the practice list, thus creating the regular reading pattern that was observed. Timing the responses during the test list provides distinct results for both the coordinate and compound groups. As mentioned in the observation, the compound demonstrates a slightly irregular reading pattern, which when timed, indicated that they infrequently changed the intervals of time between each word. The most common intervals were 1.5-2 seconds with an occasional 3 second interval occurring. The information recorded in the last column then, enumerates the occurrences of time change in the intervals between words. As indicated in the total for the compounds, 8 changes in the time allotted between each word was the maximum.

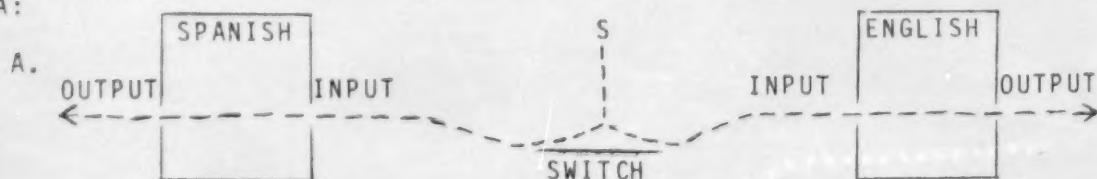
The coordinates on the other hand, exhibited 3, 4, and 5 second intervals as the common time spent between utterances. Regarding the number of changes in this interval time, as noted for the coordinates, their minimum is 5 with a maximum of 23, far surpassing the results of the compound.

In summary, there are two distinct observations resulting from the information contained in the last column of TABLES I and II. It is the compound who experiences few interval time changes with the common interval time never exceeding 3 seconds. The coordinate however, experienced numerous interval time changes with his common interval time frequently exceeding 3 seconds.

Chapter IV: Discussion and Speculations

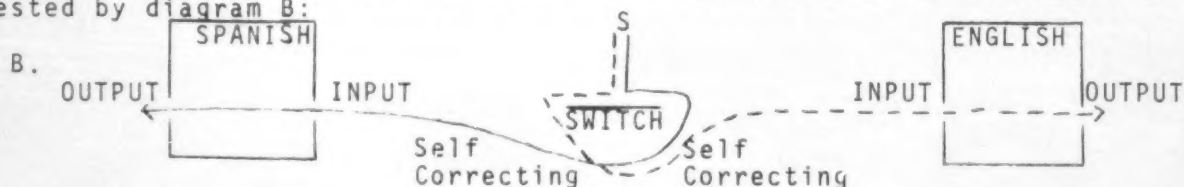
The results stated in Chapter III on the whole, exhibit a distinction among bilinguals. It is the purpose of this chapter to relate that distinctive evidence to the coordinate/compound theory of bilingualism as it is related to the phonological component of language. In order to proceed with such a discussion, a model of the bilinguals' phonological apparatus must first be suggested.

Since the underlying basis for distinguishing coordinate and compound bilinguals in previous studies, is the separation or fusion of their two language systems, that basis will be maintained in this study. For the coordinate bilingual then, the phonological apparatus can be represented by diagram A:



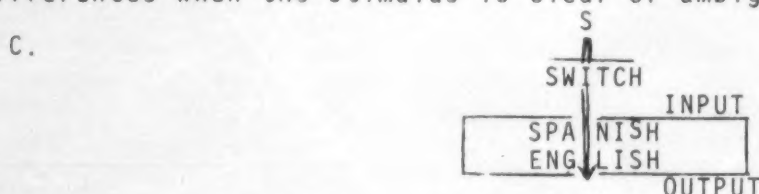
This model represents the separate storage of the phonologies of the coordi-

nates L_1 and L_2 , both of which are constantly activated. When the bilingual is presented with a stimulus (S) such as the visual cue of the phoneme sequences contained in the practice list, that stimulus is directed by some switch or device to be interpreted either by the Spanish or English system. When the stimulus is ambiguous, as are the phoneme sequences in the test list, another operation is involved within the same phonological framework as suggested by diagram B:



In this diagram, two switches which can be called self-correcting switches come into operation. Since the stimulus itself is ambiguous, the directive switch can fail, by leading to the incorrect phonological system. However, since there exists the separation between systems, the coordinate has time to correct the error before input into the wrong phonological component occurs. In the time it takes for the stimulus to leave the directive switch and enter as input into the phonological component, is sufficient time for the coordinate bilingual to make use of secondary stimulus as additional evidence to interpret the language of the original stimulus. In this study, each subject had available the color coding system as this secondary stimulus, whereas in real life situations the bilingual may have to rely on contextual clues. In either case, if the secondary stimulus indicates the directive switch has failed and is leading to the incorrect phonological interpretation, the self-correcting switch redirects the stimulus for proper phonological encoding.

The model in diagram C, selected for the compound is different in three respects. First it represents the fused storage system of the bilinguals' two phonologies; second it represents a device in which only one phonological system can be activated at one time; and third it demonstrates no operational differences when the stimulus is clear or ambiguous.



When the compound bilingual is presented with a stimulus, visual or otherwise, the switch located near the input to the combined English and Spanish phonological system interprets the stimulus as either English or Spanish and simultaneously activates the appropriate phonology.

Relating the results to the proposed phonological models offers an explanation of the distinctive behavior observed of the 2 groups of bilinguals. Regarding the number of errors and interval time changes, the following observation can be stated; it seems that the coordinates use longer time intervals in order to achieve more accuracy; the compounds use shorter time intervals and achieve more inaccuracy. Considering the models A, B, and C, it is apparent that the coordinates have time available to them between the directive switch and the actual input of the stimulus, whereas for the compounds, the switch and input occur practically in the same operation. At this point, the question arises, that if there exists such a time lag for the coordinates, then why do both groups of bilinguals manifest the ability to switch language (phonologies) without pausing, sometimes even within the same utterance. One possible

answer to this question was mentioned by Macnamara (1967). He suggests that perhaps a model, such as the one proposed here for the coordinates, is activated far in advance of the overt manifestation of language switching. For example, in a natural situation the bilingual reading a mixed language passage, would be able to focus on the stimulus and activate the switch far in advance of the actual reading of this language change. In this testing situation however, the bilingual was unable to focus on preceding nor succeeding stimuli, consequently being unable to activate the switching mechanism in advance of the switch. This was obvious from the number of silent intervals the coordinate exhibited between responses. The compounds never having this time available, demonstrated less time between responses on the test list.

Turning the discussion to error analysis, the anticipated outcome mentioned in the hypothesis stated in Chapter I must be reiterated. It was the coordinate bilingual who was to experience minimal interference and the compound who would demonstrate extensive interference in language switching. The test results however, do not support this assumption. On the contrary, it is the coordinate for whom the majority of the errors are due to interference and it is the compound for whom the errors are due equally to interference as well as to other reasons. An explanation of these findings can be sought by analyzing the proposed models A, B, and C.

When the coordinate makes an error in interpreting an ambiguous stimulus such as that found in the test list, apparently the self-correcting switch is not functioning to redirect this stimulus toward the appropriate phonological system. It must be remembered that the only time this switch functions is when the interpretation of the secondary stimulus is not in accordance with that for the original stimulus. At the time of error then, the coordinate is not consulting the secondary stimulus in time, and consequently an overt error is observed. There were three observations that seem to support the assumption that the use of the secondary stimulus available in the test list (color coding) was initially delayed by the coordinates. First, the majority of the coordinates' errors occurred near the beginning of the test list, indicating that some factor was deficient at that time. Second, the fact that 2 coordinates stopped to ask for a repetition of the color coding system near the beginning of the test indicates this rule was deficient for them. Third, it was only the coordinate who was conscious of his errors, and acknowledged this awareness by immediate correction, or by an exclamatory remark. One reason that the coordinate delayed the recognition of color coding as secondary stimulus, may be due to the unnaturalness of this stimulus, since in real language switching situations, the bilingual relies on stimuli such as contextual clues.

The errors of the compound bilingual seem to suggest that his interpretation of ambiguous stimuli is randomly performed. Although the compound also has the above mentioned secondary stimulus available to him, there is no time in which to redirect the language switch based on the information supplied by secondary stimulus. If color coding is used to make unambiguous the original stimulus, it must be done in conjunction with the original stimulus since no time is available to the compound afterwards.

As a final point of this discussion, the distribution of errors into type I and type II word categories will be considered for both groups of bilinguals. As explained earlier, type I words have identical denotative meanings while type II words do not. Since the coordinate rarely makes an error on a type II word, may indicate that with coordinate bilingual experience he has become sensitive to semantic differences between languages. That is, since he has separate space to store two complete language systems this bilingual had the opportunity to learn to distinguish ambiguous language stimuli based on their semantic aspects. On the other hand, the compound is as likely to err on a type I word as with a type II word. This observation suggests that the compound,

unlike the coordinate, has had minimal experience with semantic differentiation between his 2 languages, and consequently is not apt to use semantics as a device to clear ambiguity.

This discussion of the test results has been an attempt to provide empirical evidence for the need to group bilinguals into some dichotomy, such as the coordinate/compound, based on their phonological storage systems. Although it is strongly suggested that certain bilinguals possess 2 separate phonological systems while others possess only one, perhaps the most convincing evidence will be the following. Upon completion of section III of the test used in this study, several unsolicited comments were made by the subjects. One compound expressed that she felt a great deal of confusion when reading the test list since for every word she could envision two possible pronunciations. It was a major task then, to ultimately decide which pronunciation to use. A coordinate subject remarked that reading the same test list was a rather simple task. This subject compared herself to a two track tape player, which was able to switch into one track for Spanish and into the other for English with great ease.

Implication for Further Research

A question for further investigation would involve testing bilinguals who possess two languages belonging to the same language family, such as Spanish and Italian, to determine if a separate phonological storage is still maintained.

Another interesting study could focus on the comparison of the coordinate bilinguals' dual phonological storage system, to that of a bidialectal monolingual. It would be interesting to determine if the factors involved in classifying coordinate and compound bilinguals used in this study, would also classify bidialectals into 2 similar groups.

Finally, after a study is performed with bilinguals, the question arises concerning the multilingual individual. An expansion of this present study could be performed to determine the phonological apparatus available to the multilingual, and its relation, if any, to the coordinate/compound phonological storage systems.

Chapter V: Summary

The phonological switching processes of 16 bilingual (Spanish - English) adults were observed to provide phonological evidence for the coordinate/compound theory of bilingualism.

Each subject was categorized as a coordinate or compound based on responses to a questionnaire. Results of a test which involved the reading of a mixed list of Spanish and English words was recorded for each subject.

As anticipated, the results were distinctive for both the coordinate and compound groups. Speculations were made concerning possible phonological models for both bilingual groups. An explanation of the test results followed, based on the operation of the proposed coordinate and compound phonology systems.

Implications for further related research are mentioned following a discussion of the results.

This study has demonstrated in this instance, that Spanish and English bilinguals store their Spanish and English phonologies as either one combined system, or as two separate and independent systems.

* * *

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* * *

APPENDIX A

I. Complete this questionnaire:

1. Name (optional) _____
2. As a young child, did you speak BOTH Spanish and English? ☐ YES ☐ NO

IF THE ANSWER TO #2 IS YES, ANSWER THE FOLLOWING:

- a. Where were you born? _____ (country)
- b. What language did your parents speak? ☐ English ☐ Spanish
☐ both English and Spanish
- c. Did you speak BOTH Spanish and English at home AND away from home?
☐ YES ☐ NO (explain) _____
- d. In what language did you receive most of your education?
☐ English ☐ Spanish ☐ both English and Spanish
- e. Do you feel more "comfortable" using:
☐ English ☐ Spanish ☐ the same in English and Spanish

IF THE ANSWER TO #2 IS NO, ANSWER THE FOLLOWING:

- a. Which is your first language? ☐ English ☐ Spanish
- b. Where did you learn your first language? _____
country/city
- c. Which is your second language? ☐ English ☐ Spanish
- d. Where did you learn your second language? _____
country/city
- e. How long did you speak your first language before learning your second language? _____
- f. Which language did your parents speak?
☐ English ☐ Spanish ☐ both English and Spanish

g. In what language did you receive most of your education?

☐ English ☐ Spanish ☐ both English and Spanish

h. Do you feel more "comfortable" using:

☐ English ☐ Spanish ☐ the same in English and Spanish

STOP!!!

* * *

APPENDIX B

I. Conteste las preguntas siguientes:

1. Nombre (a su discreción) _____

2. ¿Cuándo Ud. era niño/a, hablaba los dos idiomas inglés y español?

☐ SÍ ☐ NO

SI LA CONTESTACIÓN A #2 ES SÍ, CONTESTE LAS PREGUNTAS SIGUIENTES:

a. ¿En dónde nació? _____

país

b. ¿Cuál idioma hablaban sus padres? ☐ inglés ☐ español

☐ los dos, inglés y español

c. ¿Habla Ud. español y inglés en su casa y con sus amigos?

☐ SÍ ☐ NO (explique) _____

ch. ¿En qué idioma recibió Ud. la mayor parte de su educación?

☐ inglés ☐ español ☐ inglés y español

d. Se siente más cómodo usando:

☐ inglés ☐ español ☐ lo mismo con inglés y español

SI LA CONTESTACIÓN A #2 ES NO, CONTESTE LAS PREGUNTAS SIGUIENTES:

a. ¿Cuál es su primer idioma? ☐ inglés ☐ español

b. ¿En dónde aprendió Ud. su primer idioma? _____

país/ciudad

c. ¿Cuál es su segundo idioma? ☐ inglés ☐ español

ch. ¿En dónde aprendió Ud. su segundo idioma? _____

país/ciudad

d. ¿Por cuánto tiempo habló Ud. su primer idioma antes de aprender el segundo? _____

e. ¿Cuál idioma hablaban sus padres? ☐ inglés ☐ español ☐ inglés y español

f. ¿En qué idioma recibió Ud. la mayor parte de su educación?

☐ inglés ☐ español ☐ inglés y español

g. Se siente más cómodo usando:

☐ inglés ☐ español ☐ lo mismo con inglés y español

¡¡ESPERE!!

APPENDIX C

Instructions: Materials - test papers; 2 sets of word cards; tape recorder.

1. Number each response sheet.
2. Answer part I, tell me when you are ready for part II.
3. I will say 2 words. After you hear each word, form a mental picture of what that word represents.

1. casa house

Now mark the answer to #1 in part II. Indicate if the mental picture for _____ was the same or different from the mental picture for _____.

2. family	familia
3. church	iglesia
4. parque	park
5. cocina	kitchen

4. First we will have a practice test. In front of you is a set of words. Some words are in Spanish and some in English. All the Spanish words are written in RED and all the English words are written in BLACK. When the tape begins, read all the words. Any questions?
5. Now do the same thing with this set of words.

Instrucciones:

1. Ponga el número de cada examen.
2. Conteste parte I, díme cuando está listo por parte II.
3. Voy a decir 2 palabras. Después de cada palabra, haga un imagen mental de lo que representa cada palabra.

1. casa house

Ahora, conteste #1 de part II. Indica si la imagen mental para _____ fue lo mismo o diferente de la imagen mental para _____.

2. family	familia
3. church	iglesia
4. parque	park
5. cocina	kitchen

4. Primero vamos a tener un examen de practica. Aquí está un grupo de palabras. Algunas son de español, y otras son de ingles. Las palabras españolas son escritas en ROJO y las palabras inglesas son escritas en NEGRO. Cuando empiece el grabador, lea todas las palabras. ¿Hay preguntas?
5. Ahora, haga lo mismo con este grupo de palabras.

APPENDIX D

PRACTICE LIST

chair	eat
table	viene*
lamp	bed
bolsa*	que*
paper	call
pluma*	escribir*
lapiz*	forget
vestido*	year
blouse	maestro*
muchacho*	tengo*
boat	summer
libro*	cocina*
hablo*	class
free	hermoso*
agua*	looked
people	quiero*
house	saw
mano*	fecha*
felt	talked
dedo*	azul*

TEST LIST

Florida	dime*
popular	angel
vision	general*
interior*	sale
decision	hay*
rodeo*	come
tropical*	fin*
cafeteria*	pan
revolver	brillo
me*	son*
hotel	pie*
piano*	real
plaza*	seas*
usual	vine
sin*	mayor*
San Francisco	has
cancer	patio*
chocolate*	lean
doctor*	dan*
hospital	case

*indicates word was printed in red